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Rev.

Abstracts of Scientific Documents Submitted to the Commission for the 2016 CSRS Meeting

by

NPAFC Secretariat

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Abstracts of Scientific Documents Submitted to the Commission for the 2016 CSRS Meeting

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Keywords: migration, survival, climate, monitoring, stock identification, status of salmon, salmosphere

This document is a compilation of abstracts of new and revised scientific documents submitted to the Commission between adjournment of the 2015 Annual Meeting and April 25, 2016. The compilation is organized into three sections.

Section 1 lists the document number and title according to four topics. The first three topics are a partial list of proposed research themes being considered for the next NPAFC Science Plan.

(1) Status of Pacific Salmon: to understand the present status of salmon and their environment
(2) Salmon in a Changing Salmosphere: to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon distribution and abundance and to make projections of their future changes
(3) New Frontiers: to investigate new technologies and analytical methods to advance salmon science and to explore the unchartered regions of the salmosphere

For convenience, one more topic was added:

(4) Other Topics

Individual documents may pertain to more than one topic and, therefore, may be listed more than once. The salmosphere means the current and future geographic range of salmon in the Subarctic and Arctic.

Section 2 lists the document number and title according to the country that submitted the document. Documents submitted by CSRS working groups or the Secretariat are not listed in this section.

Section 3 lists abstracts of documents in order of document number.

Documents submitted during the specified time period include 31 new documents (including two documents that were revised in 2016 before the meeting), plus two revised 2015 documents and one revised 2012 document for a total of 34 documents. Including all the submitted documents (n=34), 31 documents related to status of Pacific salmon, four documents related to salmon in a changing salmosphere, one document related to new frontiers, and two related to other topics. Of the 34 documents, five were submitted by Canada, 10 by Japan, three by Korea, seven by Russia, and nine by the United States.

Section 1. Documents (number, title) Listed by Topic

1. Status of Pacific Salmon

Doc. 1430 (Rev. 1)	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2011
Doc. 1565 (Rev. 4)	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2014
Doc. 1587 (Rev. 1)	Proposed Otolith Marks for Brood Year 2015 Salmon in Japan
Doc. 1617	Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2014
Doc. 1624	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2015
Doc. 1625	Proposed Thermal Marks for Brood Year 2016 Salmon in Alaska
Doc. 1626	Releases of Otolith Marked Salmon from Alaska in 2015
Doc. 1627	Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2015
Doc. 1629 (Rev. 1)	Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2016
Doc. 1630	Marked Salmon Production by the Hatcheries of Russia in 2015
Doc. 1631	Proposed Otolith Marks for Brood Year 2016 Salmon in Russia
Doc. 1632 (Rev. 1)	Proposed Thermal Marks for Salmon from Canada, Brood Year 2016
Doc. 1633	Stock Estimates of Juvenile Chum Salmon Captured on the 2013 Bering Sea and Chukchi Sea Research Survey
Doc. 1635	Results of 2015 Salmon Research by the *Oshoro maru*
Doc. 1636	Preliminary Statistics for 2015 Commercial Salmon Catches in Japan
Doc. 1637	Preliminary 2015 Salmon Enhancement Production in Japan
Doc. 1638	Releases of Otolith Marked Salmon from Japan Between the Fall of 2014 and Spring of 2015
Doc. 1639	Proposed Otolith Marks for Brood Year 2016 Salmon in Japan
Doc. 1640	The Summer 2015 Japanese Salmon Research Cruise of the R/V *Hokko maru*
Doc. 1641	Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2016
Doc. 1642	United States Cruise Plan for the Gulf of Alaska Assessment Survey for 2016
Doc. 1643	United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August - September 2016
Doc. 1644	Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in Summer and Fall 2016 by Russia
Doc. 1645	Russian Bibliography of 2015 Publications Linked to the Current NPAFC Science Plan
Doc. 1647	High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015
Doc. 1648	On the Relationship Between Survival of Chilko Lake Sockeye Salmon Smolts and Sea Surface Temperature and Satellite Derived Chlorophyll Concentrations
Doc. 1649	Korean Salmon Catch Statistics and Hatchery Releases in 2015-2016

Doc. 1650	Korean Research Plan for Salmon in 2016
Doc. 1651	Otolith Thermal Mark for Brood Year 2015 and Proposed Thermal Marks for Brood Year 2016 Chum Salmon in Korea
Doc. 1654	Canadian Salmon Catch and Enhanced Salmon Production in 2014 and 2015 with a Historical Overview of Recreational Steelhead Catches
Doc. 1656	Canadian Juvenile Salmon Surveys in 2016-2017

2. Salmon in a Changing Salmosphere

Doc. 1618	Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2014 Returns and 2015 Forecast
Doc. 1645	Russian Bibliography of 2015 Publications Linked to the Current NPAFC Science Plan
Doc. 1654	Canadian Salmon Catch and Enhanced Salmon Production in 2014 and 2015 with a Historical Overview of Recreational Steelhead Catches
Doc. 1640	The Summer 2015 Japanese Salmon Research Cruise of the R/V *Hokko maru*

3. New Frontiers

Doc. 1640	The Summer 2015 Japanese Salmon Research Cruise of the R/V *Hokko maru*

4. Other Topics

Doc. 1628	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2016
Doc. 1634	Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2015

Section 2. Documents (number, title) Listed by Country

Canada

Doc. 1627	Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2015
Doc. 1632 (Rev. 1)	Proposed Thermal Marks for Salmon from Canada, Brood Year 2016
Doc. 1648	On the Relationship Between Survival of Chilko Lake Sockeye Salmon Smolts and Sea Surface Temperature and Satellite Derived Chlorophyll Concentrations
Doc. 1654	Canadian Salmon Catch and Enhanced Salmon Production in 2014 and 2015 with a Historical Overview of Recreational Steelhead Catches
Doc. 1656	Canadian Juvenile Salmon Surveys in 2016-2017

Japan

Doc. 1587 (Rev. 1)	Proposed Otolith Marks for Brood Year 2015 Salmon in Japan
Doc. 1628	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2016
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Doc. 1640	The Summer 2015 Japanese Salmon Research Cruise of the R/V *Hokko maru*

Republic of Korea

Doc. 1649	Korean Salmon Catch Statistics and Hatchery Releases in 2015-2016
Doc. 1650	Korean Research Plan for Salmon in 2016
Doc. 1651	Otolith Thermal Mark for Brood Year 2015 and Proposed Thermal Marks for Brood Year 2016 Chum Salmon in Korea

Russia

Doc. 1430 (Rev. 1)	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2011
Doc. 1565 (Rev. 4)	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2014
Doc. 1624	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2015

United States

Section 3. Document Abstracts (numerical order)

Doc. 1430 (Rev. 1) **Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2011**

Pacific Research Fisheries Center (TINRO-Center) and Russian Federal Research Institute of Fisheries and Oceanography (VNIRO)

Salmon catch (commercial, subsistence, and sport), average weights, hatchery releases, and escapement statistics for 2011 are presented.

Doc. 1565 (Rev. 4) **Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2014**

N.V. Klovach, O.S. Temnykh, V.A. Shevlyakov, E.V. Golub, A.N. Kanzeparova, E.A. Shevlyakov, A.M. Kaev, and V.V. Volobuev

Salmon catch (commercial, subsistence, and sport), average weights, hatchery releases, and escapement statistics for 2014 are presented.

Doc. 1587 (Rev. 1) **Proposed Otolith Marks for Brood Year 2015 Salmon in Japan**

Yasuo Tomida, Shuichi Toda, and Shigehiko Urawa

Japan plans to mark approximately 271 million salmon of the 2015 brood year (241.7 million chum, 25.4 million pink, 3.4 million masu, and 150 thousand sockeye salmon) using 104 discrete thermal patterns and four ALC (alizarin complexone) patterns at 49 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1617 **Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May – August 2014**

Joseph A. Orsi and Emily A. Fergusson

Juvenile Pacific salmon (*Oncorhynchus* spp.), ecologically-related species, and associated biophysical data were collected from the marine waters of the northern region of southeastern Alaska (SEAK) in 2014. This annual survey, conducted by the Southeast Coastal Monitoring (SECM) project, marks 18 consecutive years of systematically monitoring how juvenile salmon utilize marine ecosystems during a period of climate change. The survey was implemented to identify the relationships between year-class strength of juvenile salmon and biophysical parameters that influence their habitat use, marine growth, prey fields, predation, and stock interactions. Up to 13 stations were sampled monthly in epipelagic waters from May to August (total of 23 sampling days). Fish, zooplankton, surface water samples, and physical profile data were collected during daylight at each station using a surface rope trawl, bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Surface (3-m) temperatures and salinities ranged from approximately 8 to 15ºC and 18 to 32 PSU across inshore, strait, and coastal habitats for the four months. A total of 79,524 fish and squid, representing 29 taxa, were captured in 97 rope trawl hauls fished from June to August. Juvenile salmon comprised approximately 13% of the total fish. Juvenile pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon occurred in 50-92% of the hauls by month and habitat, while juvenile Chinook salmon (*O. tshawytscha*) occurred in about 20% of the hauls. Abundance of juvenile salmon was high in 2014; peak CPUE occurred in July in strait and coastal habitats. Coded-wire tags were recovered from 35 coho salmon and 5 Chinook salmon that primarily originated from hatchery and wild stocks in SEAK sampled in the strait habitat; an additional 6 adipose-clipped individuals without tags (presumably originating from the Pacific Northwest) were recovered mainly in

coastal habitat, where a non-Alaskan juvenile coho and Chinook were recovered (both Oregon origin). Of the juvenile salmon examined for otolith marks, Alaska enhanced stocks comprised 64% of the juvenile chum and 32% of the juvenile sockeye salmon. Of the 147 potential predators of juvenile salmon, predation on juvenile salmon was observed in 2 of 11 fish species examined. The long term seasonal time series of SECM juvenile salmon stock assessment and biophysical data is used in conjunction with basin-scale ecosystem metrics to annually forecast pink salmon harvest in SEAK. Long term seasonal monitoring of key stocks of juvenile salmon and associated ecologically-related species, including fish predators and prey, permits researchers to understand how growth, abundance, and interactions affect year-class strength of salmon during climate change in marine ecosystems.

Doc. 1618 **Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2014 Returns and 2015 Forecast**

Alex C. Wertheimer, Joseph A. Orsi, and Emily A. Fergusson

The Southeast Alaska Coastal Monitoring (SECM) project has been sampling juvenile salmon (*Oncorhynchus* spp.) and associated biophysical parameters in the northern region of Southeast Alaska (SEAK) annually since 1997 to better understand effects of environmental change on salmon production. A pragmatic application of the annual sampling effort is to forecast the abundance of adult salmon returns in subsequent years. Since 2004, peak juvenile pink salmon catch-per-unit-effort ($CPUE_{cal}$), adjusted for highly-correlated biophysical parameters, has been used to forecast adult pink salmon harvest (*O. gorbuscha*) in SEAK. The 2014 SEAK harvest was 37.2 million fish, the largest even-year harvest since 2004. The SECM forecast was for a relatively strong even-year return of 29.9 M fish, which turned out to be 20% lower than actual. Nine of 11 forecasts over 2004-2014 have been within 20% of the actual harvest, with an average forecast deviation of 9%. The 2014 harvest is indicative of continued recovery of the even-year run since the very poor return in 2006. However, most (89%) of the harvest was in southern SEAK, and some areas in northern SEAK had very poor escapements. For the 2015 forecast, model selection included a review of ecosystem indicator variables and consideration of additional biophysical parameters to improve the simple single-parameter juvenile CPUE forecast model. Two measures of CPUE were examined for forecast efficacy: $CPUE_{cal}$, the time series of CPUE calibrated for changes in sampling vessels; and $CPUE_{ttd}$, catch per distance trawled. An alternative model using the regression of harvest and the average ranks of select ecosystem indicators, was also considered. The "best" forecast model for 2015 included two parameters, the Icy Strait Temperature Index (ISTI) and juvenile $CPUE_{cal}$. The 2015 forecast of 54.5 M fish from this model, using juvenile salmon data collected in 2014, had an 80% bootstrap confidence interval of 48-58 M fish.

Doc. 1624 **Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2015**

N.V. Klovach, O.S. Temnykh, V.A. Shevlyakov, E.V. Golub, A.N. Kanzeparova, E.A. Shevlyakov, L.V. Romasenko, and V.V. Volobuev

Salmon catch (commercial, subsistence, and sport), average weights, hatchery releases, and escapement statistics for 2015 are presented.

Doc. 1625 **Proposed Thermal Marks for Brood Year 2016 Salmon in Alaska**

Dion S. Oxman

In Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool applicable to a variety of situations. For brood year 2016, approximately 65 million sockeye, 840 million pink salmon, 705 million chum, 13 million coho, and 9 million

Chinook salmon will be marked at 25 different hatcheries using 99 thermal marks, three dry marks, and one strontium mark.

Doc. 1626 **Releases of Otolith Marked Salmon from Alaska in 2015**
Dion S. Oxman

In Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool for a variety of situations. This document reports the otolith mark patterns applied to hatchery-raised salmon stocks released in Alaska during 2015. It includes five species of salmon from brood years 2013 through 2015. Release numbers, mark patterns, and release locations are summarized.

Doc. 1627 **Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2015**
Terry D. Beacham, Colin Wallace, Shunpei Sato, and Shigehiko Urawa

Stock composition of sockeye salmon (*Oncorhynchus nerka*) caught in the southern central Bering Sea during a Japanese research cruise in the summer of 2015 was estimated through an analysis of microsatellite variation. Variation at 14 microsatellites was analyzed for immature sockeye salmon, and a 415-population baseline spanning Japan, Russia, Alaska, Canada, and Washington State was used to determine the stock composition of the fish sampled. Alaskan-origin sockeye salmon were the most abundant in the catch, comprising 91% of all sockeye salmon caught, with the catch dominated by sockeye salmon of Bristol Bay origin (74%). Canadian-origin salmon accounted for an average of 8% of the annual catch, while Russian-origin sockeye salmon accounted for 1% of the annual catch.

Doc. 1628 **Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2016**
Fisheries Research Agency

Japanese research vessels are scheduled to conduct seven surveys for pelagic fishes and squids in the North Pacific Ocean in 2016. These surveys have a possibility of incidental salmon catch during fishing operations conducted using driftnets or trawls. In the case of driftnet operations, the length of the driftnet will be less than 2.5 km at sea.

Doc. 1629 (Rev. 1) **Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2016**
Kengo Suzuki, Shunpei Sato, Shigehiko Urawa, and Toru Nagasawa

Two Japanese research vessels are scheduled to conduct high-seas salmon surveys. The Fisheries Research Agency research vessel *Hokko maru* will carry out a summer monitoring survey for salmon and their habitat in the central Bering Sea. The Hokkaido University research vessel *Oshoro maru* will accomplish two salmon researches in the North Pacific Ocean in middle May, and between late June and early July, 2016.

Doc. 1630 **Marked Salmon Production by the Hatcheries of Russia in 2015**
Elena Akinicheva, Vladimir Volobuev, Evgeny Fomin, and Maksim Myakishev

In Russia, hatcheries mark salmon to evaluate the number of hatchery-raised salmon returns. This information is combined with research on migration and distribution of young salmon in coastal and exterritorial waters. The marking at hatcheries is conducted using two methods: thermal and "dry". Most of the hatcheries are located on Sakhalin and Kuriles, therefore this is the place where the greatest number of marked young salmon (about 89.7 % in 2015) are released.

Doc. 1631 **Proposed Otolith Marks for Brood Year 2016 Salmon in Russia**
Elena Akinicheva, Vladimir Volobuev, Evgeny Fomin, and Maksim Myakishev

Mass-marking of juvenile salmon is an important tool that allows for definition of the origin of a fish at all stages of its life. In Russia, otolith-marking is used to provide information about the contribution of hatchery fish to commercial and cost-recovery fisheries during the summer fishing season. In addition, it provides researchers in Russia with information to differentiate hatchery and wild salmon during the early marine period. Recovery of otolith marked fish provide information concerning distribution of young salmon at sea, including movement and abundance. Detection of marked salmon during the period of their ocean residence can determine the area of distribution and the migration pathway for salmon of different origins. This method provides an opportunity to recognize salmon from different reproduction areas and hatcheries (Kamchatka, Sakhalin, Magadan and Khabarovsk regions). This document represents the marking plan for Pacific salmon for the 2016 brood year in Russia.

Doc. 1632 (Rev. 1) **Proposed Thermal Marks for Salmon from Canada, Brood Year 2016**
Susan DiNovo and Wilf Luedke

Thermal marking continues to play an important role for both research and fisheries management in Canada. Canada plans to thermally mark approximately 79 million Pacific salmon for release in 2017/18. Thermal marking will include 70 thermal marks applied at 17 hatcheries with marked salmon released at 44 locations. The plan is similar to the 2015 brood year marking plan for fish planned for release in 2016/17.

Doc. 1633 **Stock Estimates of Juvenile Chum Salmon Captured on the 2013 Bering Sea and Chukchi Sea Research Survey**
Christine M. Kondzela, Jacqueline A. Whittle, Charles M. Guthrie III, and Jeffrey R. Guyon

Juvenile chum salmon (*Oncorhynchus keta*) were collected during late-summer/fall in the northern Bering and southeastern Chukchi seas as part of the 2013 U.S. BASIS/Arctic Ecosystem Integrated Survey (Arctic Eis) cruises. A small number of genetic samples were collected, most from the Chukchi Sea, and genotyped for 11 microsatellite markers to determine freshwater origin. All of the juvenile chum salmon samples were from western Alaska populations: about half from the Yukon River, one-quarter from Kotzebue Sound, and the remainder from Norton Sound and Kuskokwim/northeastern Bristol Bay. About two-thirds of the fish that originated from the Yukon River were from fall-run populations in the middle and upper reaches of the river. This study adds to a growing body of information about the early marine distribution of juvenile chum salmon from western Alaska.

Doc. 1634 **Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2015**
Shigehiko Urawa and Toru Nagasawa

Japanese research vessels conducted scientific fishing operations to assess stock status of Pacific saury and other pelagic fishes and squids using surface and midwater trawls, drift gillnets, and saury dip nets in the western and central North Pacific Ocean. A total of 180 salmon including 95 chum, 40 pink, 39 coho, one Chinook salmon, and five steelhead trout was incidentally caught during the research surveys between April and October 2015.

Doc. 1635 **Results of 2015 Salmon Research by the *Oshoro maru***

Takahiro Iida, Keiichiro Sakaoka, Yoshiyuki Kajiwara, Naoki Hoshi, Maki Ohwada, Keiri Imai, and Shogo Takagi

In order to accumulate oceanographic and biological data (including salmonids) and to clarify the oceanic structure and marine ecosystem, the T/V *Oshoro maru* conducted oceanographic observations and fishing surveys in the western North Pacific (along the 155°E longitude line). The survey was conducted during the Cruise #012 in May 2015. Nine oceanographic observations, three drift gillnet surveys, four hook and line surveys and one surface long-lime survey were conducted along the 155°E line. A total of 75 salmonids including 72 pink and 3 chum salmon were caught by gillnet and hook and line surveys. Pink salmon was the dominant species in this region. The fork length (FL) of pink salmon collected by C-gear gillnet ranged between 356-472 mm. To collect salmon samples extensively and to collect fresh salmon blood and various tissues, one surface long-line and four hook-and-line sampling operations were conducted during the Cruise #012. Almost all of caught by these gears were pink salmon. A total of one chum and 12 pink salmon were collected during the Cruise #012.

Doc. 1636 **Preliminary Statistics for 2015 Commercial Salmon Catches in Japan**

Yukihiro Hirabayashi, Toshihiko Saito, and Toru Nagasawa

The commercial catches in coastal and offshore areas of Japan in 2015 totaled 41.6 million fish (138 thousand metric tons), including 39.7 million chum (134 thousand metric tons) and 1.9 million pink (three thousand metric tons) salmon. The official specific statistics data may be available by the end of March 2017.

Doc. 1637 **Preliminary 2015 Salmon Enhancement Production in Japan**

Hiroaki Fukuzawa and Yukihiro Hirabayashi

Four species of anadromous Pacific salmon (chum, pink, masu, and sockeye salmon) are currently enhanced in Japan. A total of 1,874 million fry, juveniles, and smolts were released from Japanese hatcheries in 2015. The number of chum salmon fry released in the spring of 2015 was approximately 1,749 million fish. Japanese hatcheries also released 117 million pink salmon fry, 8,912 thousand masu salmon fry, juveniles and smolts, and 218 thousand sockeye salmon fry and smolts in the spring and fall of 2015. In 2015, the number of adult salmon captured in rivers along the Japanese coasts was 5,144 thousand fish, which corresponded to 16,968 metric tonnes in weight. The dominant and second dominant species were chum and pink salmon, contributing 95.2% and 4.6% in numbers of all salmon captured in rivers, respectively. Adult masu salmon occur in rivers of both Hokkaido and Honshu, but the number of catches was not available in Honshu. The number of adult masu salmon caught in rivers of Hokkaido was approximately 6.9 thousand fish. Anadromous sockeye salmon were caught in three rivers along the Pacific coast of Hokkaido, where the number of catches was 72 fish.

Doc. 1638 **Releases of Otolith Marked Salmon from Japan Between the Fall of 2014 and Spring of 2015**

Yasuo Tomida, Shuichi Toda, and Shigehiko Urawa

This document provides information on Japanese otolith mark releases, including release site, date, number, and mark patterns with images. From November 2014 to July 2015, approximately 242.6 million chum, 22.1 million pink, 1.6 million masu, and 67 thousand sockeye salmon (2014 brood year) with thermal marks or ALC (alizarin complexone) patterns were released in Japan. In addition, 360 thousand masu salmon smolts and 152 thousand sockeye salmon smolts (2013 brood year) were released in the spring of 2015 with thermal marks or ALC patterns. In the fall of 2014, 271 thousand juveniles of otolith-marked masu salmon (2013 brood year) were also released. Two thermal rings as a base mark were adopted to distinguish Japanese chum and pink

salmon from other stocks. The data were uploaded to the database on the website of NPAFC Working Group on Salmon Marking (http://wgosm.npafc.org/).

Doc. 1639 **Proposed Otolith Marks for Brood Year 2016 Salmon in Japan**
Yasuo Tomida, Shuichi Toda, and Shigehiko Urawa

Japan plans to mark approximately 277 million salmon from the 2016 brood year (246.0 million chum, 27.5 million pink, 3.4 million masu, and 150 thousand sockeye salmon) using 109 discrete thermal patterns and four ALC (alizarin complexone) patterns at 49 hatcheries. Two rings in the first band have been adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1640 **The Summer 2015 Japanese Salmon Research Cruise of the R/V *Hokko maru***
Shunpei Sato, Kentaro Honda, Tomoki Sato, Makoto Tomiyasu, Andrew Seitz, and Kengo Suzuki

A summer high-seas research cruise to investigate the biology of Pacific salmon was conducted from July 24 to August 13 in the Bering Sea aboard the Japanese research vessel *Hokko maru*. Research cruise activities included the collection of data on oceanography, zooplankton, micronekton, salmonids, and other organisms. In addition, seawater samples were collected for environmental DNA analysis. A total of 2,427 salmonids were caught by trawls, live-box, and angling. Chum salmon was the most abundant species (n = 1,820, 75.0%), followed by sockeye salmon (n = 455, 18.7%), Chinook salmon (n = 109, 4.5%), pink salmon (n = 38, 1.6%), and coho salmon (n = 5, 0.2%). Salmonids were measured for fork length and body and gonad weight, sex was determined, and the scales were removed for age determination. Isotope, genetic, otolith, stomach, and seawater samples were obtained for future study. Fifty chum, 14 sockeye, 10 Chinook, and one pink salmon were tagged with disk tags and released in the Bering Sea. Among tagged fish, five large chum salmon and six large Chinook salmon were released with DST magnetic tags and pop-up satellite archival tags, respectively. Age-specific catch per unit effort for each surface trawl (CPUE) and annual mean body weight in each ocean age of chum salmon from 17 monitoring stations from 2007 to 2015 are documented.

Doc. 1641 **Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2016**
Joseph A. Orsi, Andrew K. Gray, Wesley W. Strasburger, and Emily A. Fergusson

This survey plan details the proposed sampling for the Southeast Coastal Monitoring (SECM) project in May, June, July, and August of 2016. A primary objective of this SECM research to study the habitat use and early marine ecology of juvenile (age-0) Pacific salmon (*Oncorhynchus* spp.) and associated epipelagic ichthyofauna in Southeast Alaska (SEAK) and in the Gulf of Alaska ecosystem. The SECM surveys have been continuous since 1997, and have provided long-term biological and oceanographic data sets associated with all five species of wild and hatchery salmon during a period of climate change. Ecosystem metrics from this SECM time series are currently used to develop pre-season forecast models for pink salmon (*O. gorbuscha*) harvest in SEAK and additionally contribute annual NOAA ecosystem consideration reports for Chinook salmon (*O. tshawytscha*), sablefish (*Anoplopoma fimbria*), and zooplankton. The SECM project is currently supported by the Alaska Fisheries Science Center, Auke Bay Laboratories, along with supplemental funding from the Northern Fund of the Pacific Salmon Commission.

Doc. 1642 **United States Cruise Plan for the Gulf of Alaska Assessment Survey for 2016**

Jamal H. Moss and Wesley W. Strasburger

Scientists from the National Marine Fisheries Service (NMFS) will conduct a fisheries oceanographic survey within the southeastern region of the Gulf of Alaska (GOA) during summer of 2016 to provide key ecological data on the pelagic ecosystem, examine oceanographic transport mechanisms, lower trophic level production, age-0 marine fish distribution and energetic status, and juvenile salmon distribution and energetic status. Primary objectives of the survey will be to: (1) collect biological information on ecologically important marine fish and salmon and (2) describe the physical and biological conditions of the GOA.

Doc. 1643 **United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August - September 2016**

Kristin Cieciel and Edward Farley

This survey plan details the proposed sampling of juvenile salmon and forge fish in the northern Bering Sea in August-September 2016. This represents a project that includes participation from the Alaska Department of Fish and Game (ADF&G), US Fish and Wildlife, and the Alaska Fisheries Science Center, Auke Bay Laboratories (ABL), with funding provided from the AFSC Loss of Sea Ice (LOSI) Plan. This project builds upon prior surveys conducted in the northern Bering Sea and led by ABL.

Doc. 1644 **Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in Summer and Fall 2016 by Russia**

O.S. Temnykh and A.V. Zavolokin

Two Russian research vessels are scheduled to conduct salmon surveys in summer and fall 2016. R/V *Professor Kaganovsky* will carry out a summer monitoring survey in the Pacific waters off Kuril Islands in June-July. The primary objectives are to collect biological information on plankton and nekton communities, and describe the physical and biological oceanographic conditions in this region. The major purpose of these studies is the estimation of anadromous Pacific salmon abundance and biomass for short-term forecasting of their returns and possible catch. R/V *TINRO* will operate in the southern Okhotsk Sea. The major purpose of these studies is the estimation of catadromous Pacific salmon abundance for forecasting returns and possible catch in the following years.

Doc. 1645 **Russian Bibliography of 2015 Publications Linked to the Current NPAFC Science Plan**

V.A. Shevlyakov, O.S. Temnykh, S.V. Naydenko, M.V. Koval, N.V. Klovach, V.V. Volobuev, E.G. Akinicheva, E.V. Golub, and V.I. Ostrovsky

The bibliography lists original papers published in 2015 by Russian scientists and their collaborators relevant to the 2011-2015 NPAFC Science Plan as well as other salmon studies. The bibliography lists 70 papers, corresponding to the five key research components of the NPAFC Science Plan. Each publication is listed under one research component, although some of them are relevant to several components. The references are given with abstracts if papers included abstracts in English. Otherwise, they are listed without abstracts.

Doc. 1647 **High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015**

Michele M. Masuda, Emily A. Fergusson, Jamal H. Moss, Casey Debenham, Joseph A. Orsi, James M. Murphy, Vanessa J. Tuttle, and Thomas Holland

Information on high seas recoveries of salmonids (*Oncorhynchus* spp.) tagged with coded-wire tags (CWTs) has been reported annually to the International North Pacific Fisheries Commission (1981–1992) and to the North Pacific Anadromous Fish Commission (1993–present). Data from these CWT recoveries are also reported to the Regional Mark Processing Center (RMPC, http://www.rmpc.org) of the Pacific States Marine Fisheries Commission (PSMFC) for inclusion in their Regional Mark Information System database. This document lists recovery data for 449 CWT salmonids not previously reported to the PSMFC/RMPC. These CWTs were recovered from

(1) U.S. groundfish trawl fisheries in the Gulf of Alaska (GOA) as sampled by observers of the North Pacific Groundfish and Halibut Observer Program (NPGHOP) in 2015 (76 Chinook [*O. tshawytscha*] and 1 coho salmon [*O. kisutch*]);
(2) U.S. rockfish trawl fishery in the GOA in 2015 (27 Chinook salmon);
(3) U.S. trawl research in the GOA in 2014 (46 Chinook and 1 coho salmon);
(4) U.S. groundfish trawl fisheries in the eastern Bering Sea-Aleutian Islands (BSAI) as sampled by observers of the NPGHOP in 2015 (5 Chinook salmon);
(5) salmon excluder device testing in the BSAI in 2015 (3 Chinook salmon);
(6) U.S. trawl research in the northern Bering Sea in 2012 (3 Chinook), 2014 (4 Chinook), and 2015 (5 Chinook salmon);
(7) U.S. at-sea Pacific hake (*Merluccius productus*) trawl fishery in the North Pacific Ocean off Washington and Oregon in 2014 (170 Chinook and 5 coho salmon) and 2015 (49 Chinook salmon); and
(8) U.S. West Coast Catch Shares fishery off Washington, Oregon, and California in 2014 (54 Chinook salmon).

No new CWT recoveries from foreign high seas research have been reported to the PSMFC/RMPC since 2010.

Doc. 1648 **On the Relationship Between Survival of Chilko Lake Sockeye Salmon Smolts and Sea Surface Temperature and Satellite Derived Chlorophyll Concentrations**

Skip McKinnell and James R. Irvine

A previous study of the relationship between Chilko Lake smolt survival and chlorophyll concentrations (SeaWiFS satellite ocean colour sensor) in Queen Charlotte Sound north of Vancouver Island found that very high correlations between them could be found during spring, especially three 8-day periods from March 30 to April 22. The present study gave a similar result using the 8-day average chlorophyll data from the MODIS-A satellite (from 2003). High correlations, but few statistically significant, were also found when comparing the time series of Chilko Lake sockeye salmon smolt survival with spring chlorophyll time series at each 9 km2 pixel during the 10 ocean entry years from 2003 to 2012. Each 8-day octet in spring was analyzed separately. Analysis of the relationship between coastal (< 1000m) surface ocean temperature (SST) and smolt survival found relatively weak correlations between principal components of coastal SST and smolt survival, during the satellite era. There was no significant correlation between smolt survival and any of the SST principal components when the latter was based on non-seasonal anomalies and restricted to average values during the period April 1 to May 15. This is approximately the period of the year when the chlorophyll correlations with

survival are highest. A similar correlation result was obtained with principal components where the seasonal cycle was left in the data. During the summer when young salmon are on the continental shelf, the annual smolt survival, when compared with principal component scores averaged over the period July 1 to September 30, produced a nominally significant result ($p < 0.025$) with the 3rd largest principal component. Higher Chilko Lake sockeye smolt survivals were associated with positive values of the third principal component. Positive values of this component were associated with warmer SSTs off WCVI and colder SSTs on the north coast and beyond. Summer average values of this principal component in 2014 and 2015 were positive, however, the relatively weak correlation did not immediately inspire a newfound ability to forecast survival from SST.

Doc. 1649 **Korean Salmon Catch Statistics and Hatchery Releases in 2015-2016**

Kwan Eui Hong, Do Hyun Lee, and Ju Kyoung Kim

Total catch of chum salmon was 155,437 fish or 498.1 metric tons in 2015. The total number of chum salmon fry released was 21,800 thousand fish in 2016 (2015 brood year).

Doc. 1650 **Korean Research Plan for Salmon in 2016**

Kwan Eui Hong, Do Hyun Lee, and Ju Kyoung Kim

The Korean 2016 research plan involves investigations of mortality and climate change effects on salmon. To reveal mechanisms of mass mortality of chum salmon during their early life in rivers and coastal areas in conjunction with return rate fluctuations, the following research will be conducted:

(1) identify prey and predator species for juvenile salmon in the rivers and coastal areas;
(2) estimate stage-by-stage of survival rate after releasing salmon to rivers and coastal areas;
(3) monitor environmental factors in the river and coastal areas;
(4) examine growth rate during the early life history using size, otolith, and DNA, and compare the growth rate between hatchery and wild juvenile salmon; and
(5) investigate the optimal release period for juvenile salmon.

Climate change effects on salmon distribution, migration route, and abundance will be investigated. This research includes:

(1) continuous monitoring of environmental conditions in the Korean waters, and
(2) climate change effects on the biological characteristics of chum salmon returning to Korean waters.

Other studies will include otolith thermal marking of Korea chum salmon to provide information about growth, survival during the early ocean life stage, and hatchery origins from releases in 2016 (2015 brood year). A new multiplex PCR set using microsatellite loci of chum salmon will be developed to investigate genetic variation and population structure of Korean populations for stock identification. The genetic structure of non-anadromous and anadromous cherry salmon populations will be investigated using mitochondrial DNA to obtain baseline data for development of a strategy for conservation and management.

Doc. 1651 **Otolith Thermal Mark for Brood Year 2015 and Proposed Thermal Marks for Brood Year 2016 Chum Salmon in Korea**

Kwan Eui Hong, Do Hyun Lee, Ju Kyoung Kim, and Seung Min Yoon

Korea released 7.0 million and 8.0 million thermal marked chum salmon in March 2015 and 2016, respectively. The marks were 3,3nH(6.0 million), 3,1,4nH(1.0 million) for 2015(2014BY) and 3,1,2H(7.0 million), 4n,2,3H(1.0 million) for 2016(2015BY). We will mark approximately 8.0 million chum salmon in BY 2016, which covers about 50% ~60% of release of BY 2016 chum salmon at Namdae-cheon and Wangpi-cheon (river). Chum salmon will be marked at 2 different hatcheries (Yangyang Hatchery and Uljin Hatchery) using 2 different thermal mark patterns.

Doc. 1654 **Canadian Salmon Catch and Enhanced Salmon Production in 2014 and 2015 with a Historical Overview of Recreational Steelhead Catches**

Arlene Tompkins, Shelee Hamilton, Joan Bateman, and James R. Irvine

This document reports final catch estimates for 2014, preliminary catch estimates for 2015 for the six major salmon species in British Columbia (B.C.) and Yukon fisheries. Catch is reported for commercial fisheries (numbers and total weight) in tidal waters and recreational (numbers only) and aboriginal fisheries (numbers only) in tidal and non-tidal waters. Catches include non-Canadian origin fish caught in B.C. and exclude Canadian origin fish caught in fisheries outside B.C. A historical overview of recreational freshwater catches for steelhead is also provided. This document (1967-2013) also summarizes release information for salmon including steelhead and cutthroat trout from Fisheries and Oceans Canada (DFO) and Freshwater Fisheries Society of BC enhancement facilities in BC in 2014 and 2015.

Doc. 1656 **Canadian Juvenile Salmon Surveys in 2016-2017**

Mary Thiess, Chrys Neville, and Marc Trudel

This document provides information on the juvenile salmon research surveys planned in both offshore and inshore areas of the North Pacific Ocean by Canada for fiscal year 2016-2017. The offshore/west coast program will conduct sampling along and off the west coast of British Columbia, whereas the inshore program will conduct sampling in the Salish Sea (encompassing the Strait of Georgia and Puget Sound). These surveys are both part of long-term research programs that were initiated in 1997-1998. In addition, Canada will conduct up to four research projects in inshore waters:

(1) weekly purse seine survey in Johnstone Strait to monitor the northward migration of juvenile Fraser River Sockeye Salmon (May to July);
(2) purse seine surveys in Cowichan Bay and near Big Qualicum River on the east coast of Vancouver Island as part of a study examining factors contributing to mortality of juvenile Chinook Salmon in southern British Columbia (May to July);
(3) monthly mid-water trawl surveys in Cowichan Bay and Howe Sound to describe the distribution and movement of juvenile Chinook salmon in inshore waters from April to September; and
(4) tentative purse seine surveys in Clayoquot Sound to study distribution and timing of Chinook salmon through this area in spring and early summer (two unconfirmed dates during May and June).
